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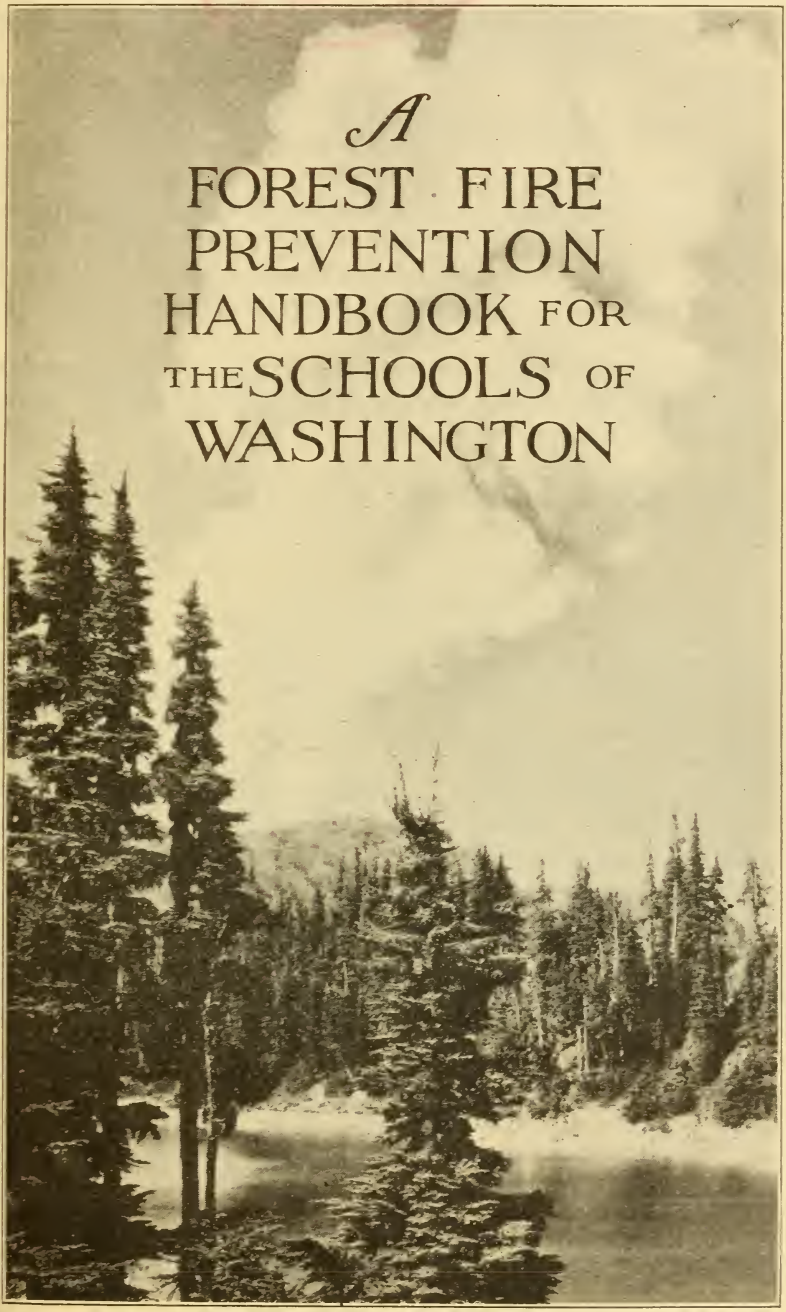
A FOREST FIRE PREVENTION HANDBOOK FOR THE SCHOOLS OF WASHINGTON



THE "RED ENEMY OF THE FOREST"

U. S. GOVERNMENT PRINTING OFFICE: 1929

FOREWORD

To the Teachers of Washington:

Washington leads all the States of the Union in lumber production. Our forest industries are the dominant factor in the prosperity of our State. The forests give us 65 per cent of our entire industrial pay roll. They are the mothers of our streams, furnishing water for irrigation, domestic and municipal use, and hydroelectric power. Forest recreation brings health and happiness to thousands of our people and helps to create our great tourist industry. Forest revenue helps build our roads and pay for our schools.

If we would continue to enjoy these things we must protect our forests and grow new tree crops to take the place of those we are now harvesting.

Fire is the great enemy of both the mature forests and the young growing tree crops. Most of the destructive fires which annually sweep through our forests are man-caused and preventable. Forest-fire prevention should be taught in the schools. It is a great public duty.

Our children will soon be citizens, and upon them will devolve the wise handling of these magnificent forest resources which we have in Washington. School teachers have an opportunity and a responsibility to see that the children are properly instructed in this important subject.

The State, Federal, and private forestry interests have cooperated in presenting forest fire prevention material to the teachers in this handy form. This book is recommended to the teachers of Washington as an essential in civics to all pupils. The most desirable time and method of use is left to their judgment.

Josephine Corliss Preston,
Superintendent of Public Instruction, and
Chairman State Board of Education.

Hugo Winkenwerder,
Dean, School of Forestry,
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E. H. Steffen,
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FOREST FIRE PREVENTION HANDBOOK FOR THE SCHOOLS OF WASHINGTON[1]

Issued by the North Pacific district of the Forest Service

In Cooperation with the State Supervisor of Forestry, the Superintendent of Public Instruction, and Private Timber Protective Organizations of the State of Washington

TO THE TEACHER

A large part of the land area of the earth was once covered with forests. As the population of each country has increased, the wooded area has decreased until now only a very few nations have enough

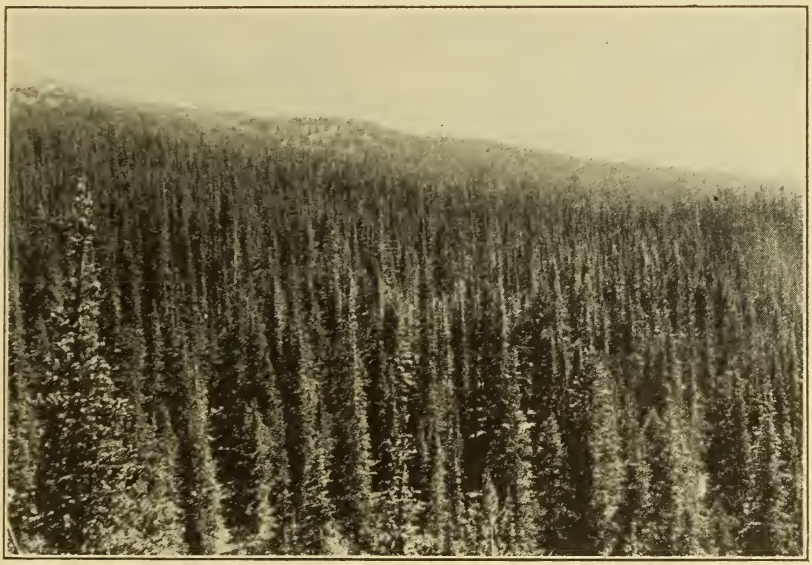

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FIG. 1.—Forest wealth

wood for their own use. In Great Britain, 95 per cent of the forests are gone, and France, Spain, Belgium, Italy, and Greece have cut over from 80 to 90 per cent of their original timberland. Though the United States is still rich in forests, the area of forested land is

[1] This is based largely on the following publication: UNITED STATES DEPARTMENT OF AGRICULTURE, CALIFORNIA DISTRICT OF THE FOREST SERVICE AND CALIFORNIA STATE FORESTER AND SUPERINTENDENT OF PUBLIC INSTRUCTION. A FOREST FIRE PREVENTION HANDBOOK FOR SCHOOL CHILDREN. U. S. Dept. Agr. Misc. Circ. 79, 30 p., illus. 1926.

only a little more than half as great as it was when the Pilgrims landed.

All nations need wood. A nation that does not have enough forests of its own must import lumber from others that have a surplus. The same is true of the States of our Union. The States with an abundance of timber must supply those that do not have enough.

Forests and the products of the forest play an important part in our lives. Thousands of articles are made from wood, to say nothing of the wood that is used in buildings, other construction work, and by the railroads. Medicines and even clothing are made from trees. Our country is now using each year 70,000,000 pounds of artificial silk made from cellulose, which is a wood product.

Besides being a source of lumber and other wood products, forests are of importance to our Nation in many other ways. They protect game and give enjoyment to all who like to take a vacation in the

F-83003

FIG. 2.—The graveyard of the forest

open. They prevent the washing away of hillsides by heavy rains, and help to check floods by holding back the melting snow and rain water and allowing it to drain off slowly instead of rushing down the bare hillsides in a torrent.

Many materials are used in place of wood, but in spite of all these substitutes there has been little or no decrease in the amount of wood consumed. On the contrary, wood now serves more purposes than ever before.

Foresters believe that each country, in order to meet its timber and wood needs, should have one-third of its land area growing forests. Three hundred years ago our country had 822,000,000 acres in forests. This was nearly one-half of the land area of the United States, not including Alaska. Now we have 138,000,000 acres of virgin forests together with 250,000,000 acres of cut-over land with some kind of timber growth, or a total of only 388,000,000 acres that

are valuable for their timber. This is only one-fifth of our total land area.

Much of the land which now bears timber is covered with only an open stand of inferior trees, and 81,000,000 acres, an area nearly twice the size of the State of Washington, is waste land that has been completely stripped of its forest growth by lumbering and repeated fires. This land should be put to work growing trees.

Trees grow by adding a layer of wood each year, called an annual ring, between the bark and the sapwood. The tip of the tree is also extended each year until, like a person, it reaches its natural height growth, which depends, as is often the case with a human being, on the family to which it belongs, and what it gets in the way of food, drink, and climate.

The present annual growth in American forests does not replace what is now being annually cut. It has been estimated that we as a Nation are using up our forests more than four times as fast as they

FIG. 3.—Forest crops; logs being hauled to the mill

grow. Each year there is cut over in the United States a forest area equal in size to Massachusetts and New Jersey combined.

Two-thirds of every tree that is cut down is left in the woods or never leaves the sawmill; only one-third of it is made into boards or articles we actually use. Insects and decay also destroy a large quantity of timber annually.

One of our greatest losses is from forest fires. In the United States each year there are about 50,000 forest fires, which burn over approximately 16,000,000 acres of timber, brush, and grasslands, and cause millions of dollars of damage. Some of these fires are set by lightning, especially in the high mountain country, but by far the greater number are due to human carelessness or malice.

It is to help prevent carelessly set man-caused fires and so reduce needless loss that this publication is written. We must all realize that not only are we destroying our forests by fires, but that we can never grow new forests if fires are allowed to kill young trees. These small

trees are our future lumber supply, and they are our only hope of replacing the forests we are now cutting.

LESSON NO. 1.—THE FORESTS OF WASHINGTON

Before learning the cause and effect of forest fires and how they are detected and fought, you will want to know where our Washington forests are located and their value to the State in various ways.

LOCATION

The forests of Washington lie along both sides of the Cascade Range and extend westward through the Olympic Mountains to the Pacific Ocean, and eastward through the Okanogan highlands. Southeastern Washington has very little timber except in the Blue Mountains in the extreme southeastern corner.

FOREST AREA [2]

The original forested area of Washington is estimated to have been about 22,000,000 acres, or a little over half the total land area of the State. The present timber area is estimated to be 14,200,000 acres. Of this, 12,050,000 acres is merchantable timber, and 2,150,000 acres is alpine, scattered, or scrubby, or otherwise nonmerchantable timber.

In addition, there are about 9,700,000 acres of land classified as immature forest area; that is, young growth, watershed area, and other land requiring forest protection. About 87 per cent of this is cut or burned over land on which young trees are growing. This land needs only protecton from fire to give us another crop of timber. The other 13 per cent is not likely to reforest without artificial aid, such as planting.

Of the total timbered area of 14,200,000 acres, 53 per cent, or 7,000,000 acres, is national property, administered by the Federal Government,[3] and 47 per cent belongs either to the State or to private owners. It is estimated that about 5,850,000 acres of the Federal land, 1,000,000 acres of State land, and 5,200,000 acres of privately owned land has merchantable timber on it.

Of the area of 9,700,000 acres classified as immature forest, 4,100,000 acres are under various forms of Federal administration.[3] Of the remainder, 200,000 acres is State land, and 5,400,000 acres is privately owned land.

KINDS OF TREES

The forests of Washington are divided roughly into two regions, differing in climate and tree growth. From the slopes of the Cascade Range westward to the ocean are the dense forests of Douglas fir, hemlock, spruce, and cedar. East of the Cascades are the open, parklike western yellow pine forests. Between these, at the higher

[2] NOTE TO TEACHERS: The statistics used in the sections "Forest area" and "Amount of standing timber and annual cut" are taken from the following article: WESTERN FORESTRY AND CONSERVATION ASSOCIATION. FOREST FIGURES FOR PACIFIC COAST STATES. Timberman 28 (6): 42–44, 46 1927. Because of pioneer conditions and the many agencies involved, compilation of accurate forest statistics is very difficult. These figures are compiled from estimates and data furnished by those in touch with forestry affairs, and while not absolutely accurate, they are representative, and probably the best available.

[3] Included in the forest land under Federal administration or control are national forests, national parks, Indian reservations, national monuments, and military reservations.

elevations of the Cascades, are the alpine woodlands. These are of low timber value at present but important for protecting the headwaters of streams, for grazing, for recreation, and for scenery.

In western Washington, the most important timber tree is the Dougles fir. This is the tree which produces a large part of Washington's lumber crop. The Douglas fir is named in honor of the young Scottish botanist, David Douglas, who first described it while pioneering for science in the Pacific Northwest in 1825. In addition to its correct English name of Douglas fir, the tree has also been called by such local names ar Oregon pine, red fir, and yellow fir. Other important westcoast trees are the western red cedar (used largely for shingles), western hemlock, and Sitka spruce.

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FIG. 4.—Growing trees for growing children

In eastern Washington the tree which is by far the most important is the western yellow pine, known by the trade name of "pondosa" pine. There are also considerable quantities of Douglas fir, lodgepole pine, western larch or tamarack, western white pine, and Engelmann spruce in eastern and northeastern Washington.

QUESTIONS

1. In what part of the State do the forests of Washington occur?
2. What was the original forest area of Washington in acres?
3. How many acres of land in Washington are classified as immature forest land? What does this term mean?
4. What percentage of this immature forest land needs only protection from fire to grow another crop of timber? How many acres is that?
5. What percentage of this immature forest land is likely to need artificial aid, such as planting, to reforest?
6. Do you judge from this that reforestation always means tree planting?
7. Name five species of Washington trees that are cut into lumber.

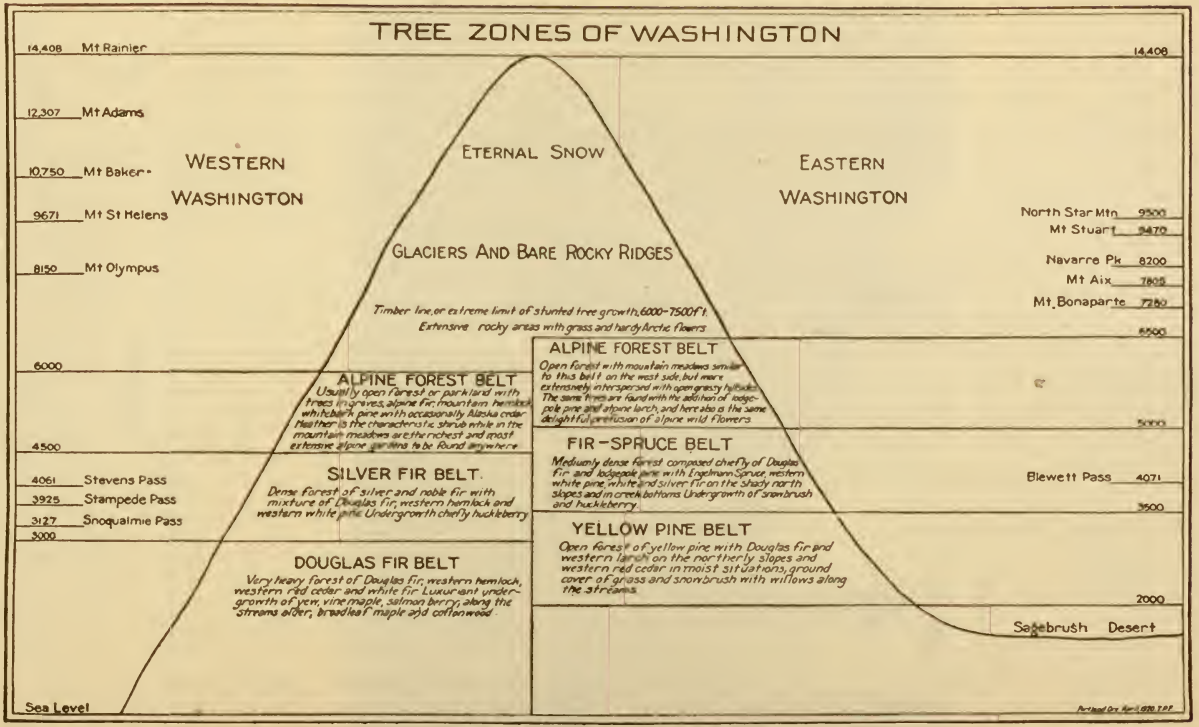

FIG. 5.—Tree zones of Washington

LESSON NO. 2.—USING THE FORESTS

AMOUNT OF STANDING TIMBER AND ANNUAL CUT

Washington's forests are estimated to contain 282,250,000,000 board feet of timber. (A board foot is the standard measure of wood, equivalent to a piece 1 foot long, 1 foot wide and 1 inch thick. Twelve board feet equal 1 cubic foot). Of this amount, 86,250,000,-

F-44421A

FIG. 6.—A forest fire at night

000 board feet is owned by the Nation, 77,927,842,000 board feet being in the national forests, and 8,322,158,000 board feet in national parks, Indian reservations, and other public lands. The State of Washington owns 22,700,000,000 board feet and the remainder, 173,300,-000,000 board feet, belongs to private timber owners. Thus it is seen that nearly two-thirds of the remaining timber in Washington belongs to private owners.

The annual lumber cut from Washington's forests amounts to about 7,000,000,000 board feet. This State has stood first in lumber production in the United States for the past 23 years (since 1905) with the exception of 1913.

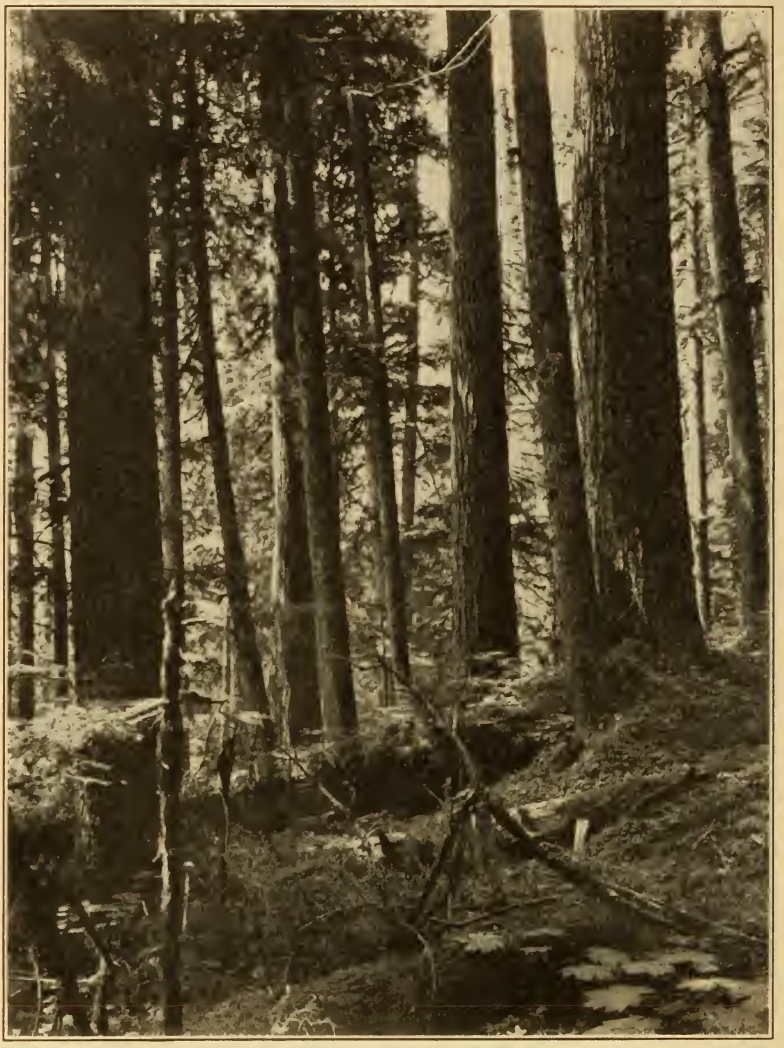

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FIG. 7.—Douglas fir; the most important lumber tree of western Washington

The value of the products cut annually from the forests of Washington is $200,000,000. The lumbering industries employ 125,000 men and furnish over one-half of the State's entire industrial payroll. These forest workers spend their money at home. They buy food, clothing, and all the necessities of life from the farmer, the merchant,

and the professional man. The forests are vital to Washington's future, and if Washington's citizens are to be kept happy, well employed, and prosperous, crops of forest trees must continue to be grown.

WATER AND FORAGE RESOURCES

The forests are of very great value in conserving the water which falls in the form of rain and snow. A blanket of mold and duff, composed of decayed leaves, needles, bark, and wood from the trees, makes the forest floor a reservoir which absorbs large quantities of water. It acts like a sponge, holding the water and delaying and retarding surface run-off, as well as returning to the soil the necessary fertilizing agents.

F-183898

FIG. 8.—A scene near timber line. Forested slopes, glaciers, and snow banks are our principal sources of water supply for irrigation, for power, and for domestic use

The water of the streams of Washington is of untold value in the life of our people. It is used not only for domestic purposes of all sorts but for irrigation and for the development of hydroelectric power.

It is estimated that there can be developed from Washington's streams over 7,800,000 horsepower of electric energy. Of this, more than 650,000 horsepower has already been developed. This electric energy is a most important factor in keeping the wheels of industry constantly moving.

Electricity is used to light our homes, run our trolley cars, pump domestic and irrigation water on the farm, and for a hundred other useful purposes. So you see how important it is that the forests, from which flow the streams that produce electric energy, should be protected from damage and destruction by fire.

As you travel through the forests of Washington, you will find large open glades, or meadows, in which grasses and flowers grow

F-217357

FIG. 9.—"White coal"

F-160831

FIG. 10.—Some ranges are best for sheep

abundantly. Also, in the open stands of timber you will notice various kinds of herbage. Cattle and sheep like to eat these grasses and weeds, and it is a common sight in summer to see them in large numbers grazing in the mountains. Within the national forests of

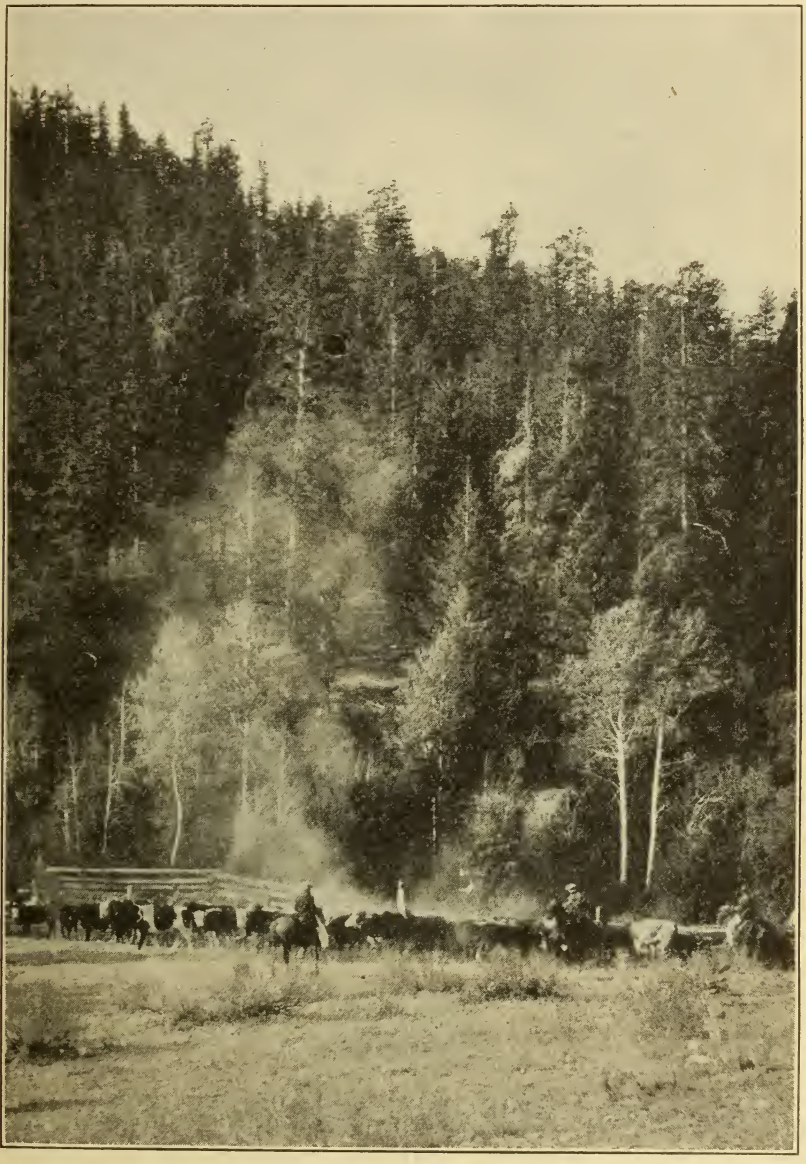

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FIG. 11.—The fall round-up

Washington there are grazed each year some 22,000 cattle and horses and 175,000 sheep. These animals are grazed under permit issued by the Government, each herd of cattle or band of sheep on its own allotted range. By furnishing forage to livestock our forests play

another important part in the economic welfare of the State, since from the cattle and sheep come meat for our tables, leather for our shoes, wool for our clothing, and many other useful products.

F-210820

FIG. 12.—Back to nature. Young and old find recreation and pleasure in the forests of Washington

RECREATION

Many people like to go to the woods for rest and recreation. With the coming of the automobile and the building of good roads people are traveling in constantly increasing numbers into the mountains to take advantage of the streams and lakes, the shade of the trees, and the restful quiet which can be found nowhere else. To provide for the comfort and convenience of these visitors, improved forest camps are established for those who wish to stop and enjoy life in the woods. As you travel the main highways through our moun-

tain country you will find many public camp grounds, established by State and Federal agencies, where there are camp tables and benches, fireplaces, and sanitary conveniences for the use of visitors.

QUESTIONS

1. How much timber is there in the forests of our State, and what proportion of it is in our national forests?
2. How much timber is cut from Washington's forests each year?
3. Why must we reforest our cut-over and burned lands?
4. Name two important forest resources other than timber.
5. How do our forests conserve water?

LESSON NO. 3.—THE FOREST ORGANIZATIONS OF WASHINGTON

As you have seen in lesson 1, the forests of Washington belong to the State, to the Federal Government, and to private owners. Each of these agencies has an organization which works in cooperation with the others in studying the forests, protecting them from fire, enforcing the laws, and educating the public so that forest fires may be prevented.

It will be interesting here to know something about the different kinds of forest properties in the State and the organizations which administer them.

STATE FORESTS

State forestry matters for Washington are under the control of the division of forestry, department of conservation and development. The forestry work is handled by the State supervisor of forestry and his assistants. Their offices are in Olympia. Throughout the State are fire wardens who work under the direction of the State supervisor of forestry.

The principal duties of the State forester's force are forest protection, forest fire prevention, the enforcement of the State forest fire laws, and the administration of the State forests. Reforestation of logged-off lands is also encouraged.

The location and areas of the State forests that have been provided for are as follows:

	Acres
Grays Harbor County	2,240
Clarke and Skamania Counties	21,801
Pacific and Wahkiakum Counties	39,548
Total	63,589

STATE PARKS AND GAME REFUGES

There are 21 State parks in Washington, with a total area of 6,500 acres. These parks are set aside for historic reasons, for their scenic beauty, or for their recreational value. Several of these parks contain fine stands of timber which should, of course, be carefully protected from fire. The State parks are handled by the State park board.

There are 1,740,321 acres of State game and bird refuges scattered throughout 23 counties of the State. Of these, 1,219,421 acres are within National-forest boundaries, and the remainder, 520,900 acres, are State or private land. These refuges are the breeding grounds

in which our native game birds and animals find safety from hunters and from which they spread out over the surrounding country. Most of our wild life depends upon the forests for its very existence. Every forest fire is a tragedy for some of the wilderness creatures.

NATIONAL FORESTS

Most of the publicly owned timber in Washington is in 10 national forests. Of these the Olympic, Mount Baker, Snoqualmie, Rainier, Columbia, Chelan, Wenatchee, and Colville lie entirely in the State of Washington. The Umatilla is partly in Washington and partly

F-195034

FIG. 13.—A forester counting the annual rings on a Douglas fir stump to learn the age of the tree

in Oregon. The Kaniksu is partly in Washington and partly in Idaho.[4]

The national forests, of which there are 151, located in 31 States and the Territories of Alaska and Porto Rico, are handled by the Forest Service, a branch of the United States Department of Agriculture, with headquarters at Washington, D. C. Each national forest is in charge of a forest supervisor, who has his headquarters in or near the forest and who is assisted by a force of specialists, rangers, and fire guards. The group of national forests in the

[4] The Kaniksu National Forest is included in the northern district under the district forester at Missoula, Mont.

States of Washington and Oregon (the north Pacific district) is under the supervision of a district forester, whose office is at Portland, Oreg.

The national forests belong to the American people. Every citizen owns an interest in them and is concerned with their welfare.

When the timber crops on the national forests are sold and harvested, arrangements are made for the growing of new crops on the same area. However, not all of the national-forest timber will be harvested for lumber. The best use for a part of it will be for other purposes, such as the protection of headwaters of streams or recreation.

NATIONAL PARKS

There is one national park in Washington, the Mount Rainier National Park. National parks are areas of nation-wide importance

F-187008

FIG. 14.—The forests are the homes of many of our game animals and birds

and interest, set aside by Congress because of their rare scenic beauty, their scientific or educational interest, or for other reasons, to be preserved in their natural state. Although the timber in a national park is never sold, it is important that it be protected from fire. A forest fire may, in a few hours, destroy scenic beauty which it would take nature many years to replace. The national parks are handled by the National Park Service, a branch of the United States Department of the Interior.

INDIAN RESERVATIONS

Some of the timber which is ordinarily classed as public or Federal timber is on the Indian reservations. Strictly speaking, this is not public timber. It is the property of the Indians, but is administered

by the Federal Government. Mature timber is being sold from these Indian reservations. The money received from the sales is made available for the benefit of the Indians.

The three most important reservations in Washington are the Yakima, the Colville, and the Quinault. The Indian Service, a branch of the United States Department of the Interior, protects this timber from fire, and handles it for the benefit of the Indians.

PRIVATE FORESTS

The owners of private timberlands are required by State law to provide forest-fire patrol for their lands. If a private owner does

F-20943A

FIG. 15.—Vast stretches of timber in the Columbia National Forest. Mount St. Helens in the distance

not make an effort to prevent the start and spread of fire from his property to that of another, he is liable for damages caused by the fire. Loggers must have fire-fighting tools handy in the woods, and their engines must be guarded against the throwing of sparks. Every owner of forest land is required by law to furnish adequate protection for such land against the starting and spread of fires thereon. If any owner fails to do so, the State forester is authorized to provide such protection, and to assess the cost against the land.

During the closed season, May 1 to October 1, no person is allowed to burn any forest material without a permit from the State supervisor of forestry or one of his wardens.

The timbermen of Washington are interested in protecting the forests from fire. They work to this end with the State supervisor

of forestry and the United States Forest Service. To handle this work the timber owners support the Eastern Washington Timber Protective Association, in Pend Oreille County; the Stevens County Timber Protective Association, in Stevens County; and the Washington Forest Fire Association, which operates in all counties west of the Cascade Mountains, with offices in Seattle. In other timber counties of eastern Washington, privately owned timber is assessed by the State and is given protection by the State division of forestry. These organizations devote their attention principally to forest protection and the education of the public in regard to care with fire in the woods. Prominent lumbermen of the five Northwestern States also belong to and support the Western Forestry and Conservation Association. This association has its offices in Portland, Oreg., and gives its attention to forestry matters of general importance, as they affect the timber interests of this region.

FIG. 16.—Busy lumber mills mean prosperity for Washington

THE CLARKE-McNARY REFORESTATION ACT

In June, 1924, Congress passed the Clarke-McNary Act. It is the purpose of this law to encourage the practice of forestry on private and State lands. Provision is made to aid States and private owners of forest land, in protection of their forests against fire. This aid is given as partial reimbursement of money spent under State direction for protection of forest lands by approved methods. The law also provides for a joint study of reforestation methods and forest taxation problems; cooperation with farmers and others through the giving of technical advice on the handling of farm wood lots; and the growing and distribution of forest nursery stock to farmers for planting of windbreaks and wood lots.

QUESTIONS

1. Where does the State supervisor of forestry have his office?
2. What are the principal duties of the State supervisor of forestry?
3. In what counties of Washington are there State forest lands? How many acres do they include?

4. How many State parks has Washington?
5. How many national forests are there in Washington; how many national parks?
6. What branch of the Government handles the national forests; the national parks?
7. What are some of the principal things the Washington law requires of private timber owners?
8. Name one of the private timber-owner's associations in this State.

LESSON NO. 4.—CAUSES OF FIRES

In Washington each year, there are on an average 1,300 fires, which burn over more than 220,000 acres, and cause damage to timber, brush, watershed cover, forage, and improvements amounting to half a million or more dollars. After reading this statement, the first question that will probably come to your mind is "What causes these destructive fires?"

LIGHTNING FIRES

Throughout the summer months the high mountain regions of Washington are frequently visited by severe thunderstorms. Bolts of lightning from these storms often strike trees. If a tree that is struck happens to be dead or has a dead top, the lightning sets fire to the wood, throws sparks into the surrounding inflammable needles and litter, and starts a forest fire. If the tree is green the lightning runs down along the trunk and sets fire to the dry needles and débris at its base. Lightning storms are known to cause about 200 fires each year in the State, and doubtless they start many more, of which we have no record and which are put out by the rains.

Lightning fires usually occur in the higher mountains. There is no way by which man can prevent them, and the best that can be done is to have the fire lookouts keep a close watch for them, and then to send a crew of men to put them out before they cover a large area.

Sometimes a very bad lightning storm will set several hundred fires in one day, and the forest rangers or wardens must work day and night to get them all out before they grow to be big fires.

MAN-CAUSED FIRES

Careless and ignorant acts of man are by far the most serious cause of devastating fires. Of the total number of fires which occur in Washington each year, 70 per cent are man-caused and could therefore be prevented.

SMOKERS

Careless hunters and fishermen, or other visitors traveling through the woods, start many fires by throwing away lighted matches, pipe heels, cigars, or cigarettes. Motorists, likewise, are guilty of throwing smoking material carelessly out of their cars, where it often falls into masses of dry, inflammable leaves, moss, needles, and grass, and flares into a blaze with the first wind that comes up. In eastern Washington grain and pasture land, and even farm buildings, are sometimes destroyed by fires set in this manner.

CAMP FIRES

Camp fires carelessly built or left unattended often spread over the forest floor or through the dry undergrowth, and in time become forest, brush, or grass fires. In this manner not only valuable timber stands and watershed areas but also many beautiful camping grounds are turned into desolate wastes. Next to smokers, campers are the greatest source of fire danger in our forests.

LUMBERING FIRES

Certain industries find it necessary to use fire in the woods. The operation of donkey engines and of locomotives, and the clearing of land by ranchers, result in many forest fires. Sparks from engines can be prevented largely by the use of proper spark arresters on the smokestacks. If small fires do start, immediate action to

F-195374

FIG. 17.—Bolts of lightning often strike trees, setting them on fire, and the flying sparks start forest fires

extinguish them will prevent damage to timber and watersheds. Ranchers can prevent fire from escaping by using care, and by burning brush and débris only when there is no danger of a fire spreading.

INCENDIARY FIRES

During the past 10-year period there has been an average of 48 incendiary fires per year in Washington. People who wilfully start forest fires are criminals in the eyes of the law. Some of them have criminal intentions, and others are merely misguided or ignorant. They think it will make grazing better, hunting better, or even that it will help protect the forest to burn it off. After several years of careful investigation by trained and experienced men representing Federal, State, and private agencies, it has been proved that uncontrolled fire always damages the forest, and should therefore be kept out.

Furthermore, burning damages grazing land. After repeated fires the range comes up to inferior grasses, weeds, and poisonous plants. Burning the woods may make hunting easier, but it never makes it better, since fires destroy the breeding grounds and the food of game. The game becomes scarcer and scarcer, until it disappears altogether. Burning of the woods also tends to dry up streams and to destroy the soil. It will be seen, therefore, that the incendiary—whether he sets the woods on fire through criminal intent or through ignorance—is always an enemy of society. It is the duty of every citizen to treat him as such.

QUESTIONS

1. Into what two general divisions can the causes of forest fires be divided?
2. Name the way in which nature starts forest fires.
3. Name the way in which man causes forest fires.
4. How do smokers start forest fires?
5. How do campers start forest fires?
6. Why is the incendiary a public enemy?

LESSON NO. 5.—THE EFFECTS OF FIRE

Uncontrolled fires in forests and fields annually destroy valuable resources that are vitally necessary to the prosperity of Washington. Some of this destruction is visible to the eye at once, but there is other damage not so clearly seen unless one knows what to look for. So we shall describe what fires actually do in timber and brush.

WHAT FIRE DOES

TIMBER FIRES

When a fire burns through a forest of growing trees it finds a large variety of fuel. On the ground is a layer of needles, twigs, and bits of bark, sometimes mixed with grass and weeds, which is very dry and easily burned during the summer, the season of greatest fire danger. Here and there is an old tree that has died and fallen on the ground. Perhaps in the timber there is a small open spot covered with brush or woody shrubs, which are also very inflammable. Fires feed on this sort of material, and some people have thought it would be a good thing to get rid of débris and undergrowth. All of this litter gradually decays, however, and acts as a fertilizer for the growing trees, which need it just as the plants in a garden need fertilizer. It is also very useful as a water conserver and in preventing erosion when heavy rains occur in the mountains. Fires in the forests not only destroy the timber and ground cover, but by burning the litter on the ground cause the water to run off faster after a storm, washing away the soil.

In many cases the soil, rocks, and débris from a burned area are washed into streams that are used for irrigation, for hydroelectric power, or for drinking water. Then the water becomes dirty, pipe lines and ditches are clogged, and trouble and expense follow. Later in the summer, when the streams from these burned areas dry up, more difficulty is caused by lack of water. Such erosion adds measurably to the silting up of our reservoirs and harbors, and necessitates costly dredging to keep the shipping channels open.

In the forest are large numbers of little trees, some in groups and some growing alone. Fire kills many of these young trees, because they are very thin-barked and tender. The loss of these little trees is serious, because after the bigger, older trees are cut, to make lumber for houses and boxes and all the other things that wood is used for, the little trees keep on growing and in time would make a second forest of big trees on the same land.

Now, we shall see what fire does to the big pines and firs and cedars. The first thing we will notice is that some of them have already been burned near the ground, so that part of the bark and wood is gone, and what we call a fire scar has been made on the trunk. This is because for centuries there have been fires in the forest, and gradually the wood has been burned away at the base of the trees.

F-35769A

FIG. 18.—Preventable waste

Burning through the needles and twigs of the forest floor, a fire comes to one of these scarred trees. All over the scar, if the tree is a pine or a fir, is pitch that the tree has put out trying to heal the wound. The fire catches in this pitch and sets the wood of the tree in a blaze. The tree then burns for hours, until finally perhaps so much of the trunk is burned away that the tree falls to the ground and lies there and rots.

A little farther on the fire may reach a dense group of big trees, with many little trees and brush on the ground and dead logs besides. If a puff of wind comes along, the fire with so much fuel at hand, flares up into the crowns of the trees and goes roaring through the forest. This is called a crown fire. Even in a short space of time it burns away all the leaves of the trees, and they die, though the trunks may stand there for years, or until they rot and fall.

So while the fire may not kill all the big trees from which lumber comes, it burns down some of them, and the heat and flames kill many

others. Probably a fifteenth to a tenth of all burned trees are destroyed and just so much wood that we need is lost.

YOUNG-GROWTH FIRES

Many people have the idea that a forest fire is doing damage only when it is burning mature or merchantable timber. One sometimes hears the remark "Oh, that fire isn't doing any damage; just burning on logged-off land." But under these slashings and brush of this logged-off land many little seedling trees usually have started to grow. Fires burning in young forest trees are doing the most serious kind of damage. If these young trees are destroyed before they mature, it is usually many, many years before another crop of trees will start on the burned area. Even apparently worthless brush patches are sheltering little trees which will be destroyed if the brush is burned.

F-188863

FIG. 19.—A fire scar. Many fires running through the forest have burned away the wood at the base of the tree, forming a giant fire scar

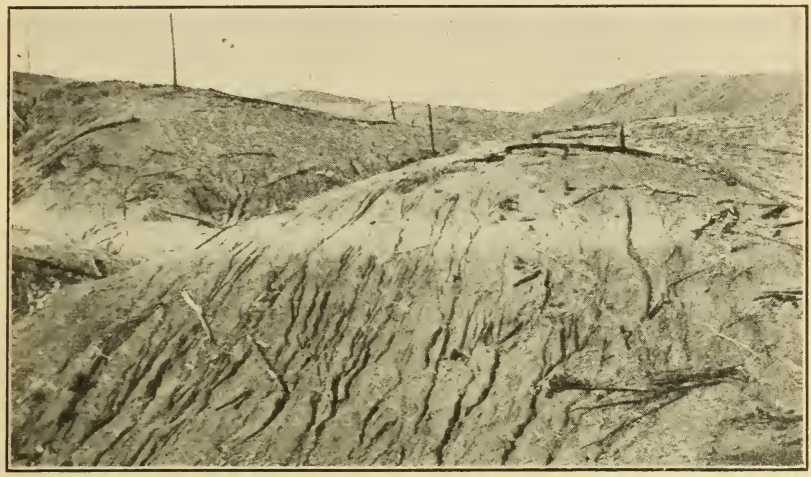
Furthermore, these young trees are growing into the next crop of timber, to be harvested when the present virgin timber is gone. If lumber mills and logging camp are to be permanent and are to continue to make the State prosperous, there must be growing crops of trees to keep them busy. So fire must be kept absolutely out of the young, growing forests, and these forests must be protected for the future. Even the apparently worthless brush patches must be protected, so that the little trees they are sheltering will not be burned.

QUESTIONS

1. What are the principal ways in which fire damages the forest?
2. Why should the small trees in a forest be protected from fire?
3. What is a crown fire?
4. In what way may forest fires affect irrigation; electric power plants; drinking water?

LESSON NO. 6.—FIRE PREVENTION

Now that you have learned how forest fires are started and what damage they cause, you will next want to know how they can be prevented. If everyone who goes into the fields and forests would



F-175334

FIG. 20.—Erosion

learn and follow the woodsmen's rules in the handling of fires, a very large number of the destructive conflagrations that now start from human carelessness would never take place.

HOW TO BUILD AND PUT OUT A CAMP FIRE

Nothing betrays the tenderfoot sooner than his fire. The woodsman, before he builds a fire, clears a place of all grass, needles, and trash, digs a hole and in it builds a small, quick fire. When the fire burns down he sits beside it and does his cooking. The tenderfoot makes a bonfire and cooks himself while he smokes and burns his food.

F-211166

FIG. 21.—Break every match in two; put out every spark

A good woodsman never builds a fire near living trees, dead logs, or underbrush, nor does he build bonfires in windy weather or where there is the slightest danger of the fire getting away. He never leaves camp, even for a short time, without first putting his fire *dead* out with a liberal supply of water and then covering it with earth.

Also, before breaking camp he cleans up and burns or buries all refuse that has accumulated during his stay, so that the next person who visits the camp will find it clean and attractive and not littered with tin cans, papers, and old clothing.

HOW TO PREVENT SMOKERS' FIRES

A good woodsman is always a careful smoker. He breaks his match in two to make sure that it is completely out before he throws it away, and stamps out with his foot every spark of fire in discarded pipe heels and cigar and cigarette butts.

A code for smokers, issued by the forest-protective agencies follows:

SMOKER'S CODE

(For the dry season)

DANGEROUS TO SMOKE WHILE TRAVELING

On forest, brush, or grass land.

SMOKE ONLY

1. While stopping in a safe place clear of all inflammable material, or
2. During or right after a heavy rain, or
3. Inside a vehicle on two-way highways, or
4. Above timber line, and

AFTER SMOKING

Put out all lighted material.

The law prohibits throwing away any burning matches or tobacco, or other lighted material in a forest region.

Many voluntarily refrain from smoking in the woods during the dry season when the danger of fires is great. Ash containers in automobiles and other vehicles, in which ashes, stubs, and unused matches may be placed, will also prevent many a fire.

A burning match, cigarette, or pipe heel thoughtlessly tossed aside into a bunch of dry grass, or down among the dry needles of a forest floor may start a serious fire, which, before it is controlled, may burn valuable grainfields, pasture and houses, or destroy large bodies of timber.

PREVENTING LOGGING FIRES

Careful loggers see to it that their donkey engines and logging locomotives are provided with proper equipment so that sparks can not get out of the smokestack or firebox to set fire to the dry brush or timber in which they may be working. Logging fires are sometimes caused by the friction of a block or pulley which has not been

F-185853

FIG. 22.—How to build a camp fire. A woodsman clears a place of all grass, needles, and trash, digs a hole, and in it builds a small fire

F-185855

FIG. 23.—How to put out a camp fire. Never leave a camp fire, even for a short time, without first putting it dead out with a liberal supply of water and then covering it with earth

properly oiled. Workmen who smoke in the woods and throw away lighted matches or smoking material, have been responsible for a good many logging fires. Many companies now have strict rules against smoking in the woods during danger periods. Workmen who violate these rules are promptly discharged.

STATE AND FEDERAL FIRE LAWS

Some one has said that if we could educate every American to be careful with fire, 95 per cent of our national-forestry problem would be solved. But some people are careless with fire even after they have been taught how dangerous it is. So the Government and most of the States have found it necessary to fix severe penalties for failure to handle fire in the way good woodsmen should.

Washington has a number of laws which prohibit acts of carelessness with fire. One law prohibits leaving camp fires burning with-

F-201187

FIG. 24.—Careful loggers sprinkling around their donkey engine to reduce the fire hazard. The box contains fire tools

out some person in attendance, or allowing a fire to escape from control. Another law prohibits the throwing away of lighted matches, tobacco, cigars, cigarettes, firecrackers, or other lighted material in any forest region in this State.

The penalties for breaking these laws may be jail sentences of from 15 days to 6 months, or fines up to $500, or both. Signs are posted throughout the forested regions of the State, calling attention to the fire laws and requesting cooperation in preventing fires. These signs and others giving valuable information to the public should never be written upon, cut, shot at, or otherwise mutilated, and you can render a public service by helping to protect them.

Fire laws are made to help prevent the fires that could be avoided if all people were as careful as they should be. Lightning will always be the cause of some fires in the forests and fields. Accidents, such as the breaking of electric power lines, will cause others. But

if everyone will adopt as his motto, "Prevent forest fires—it pays," and will do his utmost to follow in the good woodsman's footsteps in his use of fire, the losses and damage from all fires except those caused by nature or accidents will be averted.

QUESTIONS

1. What kind of a fire does a good woodsman build?
2. How does he decide upon and prepare a place in which to build it?
3. What does he do with his camp fire and the refuse in his camp before he he leaves it?
4. What does a good woodsman do with a lighted match before he throws it away? With burning tobacco?
5. What are the penalties for disobeying Washington laws against carelessness with fire?

LESSON NO. 7.—HOW FIRES ARE DETECTED AND FOUGHT

In other lessons you have learned about our forests, why and how fires damage them, how fires are caused, and how they can be prevented. Now you will want to know how fires are detected and fought in case they do start.

In cities and towns fires usually are discovered as soon as they break out and the alarm is given. When you travel in the mountains, however, you will see that extensive areas of our forests are so thinly populated and afford such obstructed views, because of mountain ranges and deep canyons, that fires might become very large before being discovered if some special means of detection were not employed.

LOOKOUTS, WARDENS, AND RANGERS

In Washington and many other States, a careful watch is maintained over forested areas by men stationed on high peaks who act as fire lookouts, and by fire guards or patrolmen who travel along roads and trails and other routes where they have a good view of areas in which fires are likely to occur. The lookout men, wardens, and rangers go on duty early in the summer and remain constantly on duty until the rains come in the fall. The lookout men occupy small buildings or observatories with windows on all sides—a "ribbon" of glass entirely around the building. Some of these houses are set on steel towers 30 to 60 feet above the ground, so that the lookout man can see over the surrounding trees or other obstructions.

Lookout men do not go to fires. Their duty is to watch for them and to telephone their location immediately to the forest rangers or wardens. The wardens and rangers travel on foot, on horseback, by motor cycle, and by automobile. When a fire is reported to them or they find one, they immediately begin work to extinguish it. It sometimes costs thousands of dollars to control a large fire.

In addition to the fire lookouts, wardens, and rangers, everyone within or near the forests (miners, stockmen, hunters, campers, motorists, etc.) should be constantly on watch for fires and should report them to the forest ranger or warden.

AIRPLANES

During recent years, airplanes have been used to some extent to assist the lookouts in discovering fires. Under certain conditions

they are a valuable aid. The airplane does its best work as a scout for making air surveys of large fires that are burning. This helps the forest officers to plan their fire fighting. Planes are also serviceable for forest patrol after lightning storms and during hazy or smoky weather.

The airplane forest patrol on the Pacific coast is under the supervision of the United States Forest Service, and gives service to the Federal, State, and private forest-protection forces.

TELEPHONE LINES

As you travel through the mountains you will find, even in many out-of-the-way places, a good system of telephone lines. These have

FIG. 25.—A modern forest-fire truck used in Washington. It has both automobile tires and car wheels and can be used either on the highway or on logging railroads. It carries tools, food, equipment, and supplies for a forest fire-fighting crew

largely been built by the Government and State to connect the homes of the forest rangers or wardens with the supervisor or man in charge of the forest. Lookout stations are connected with these forest telephone systems, and reports of fires can thus be sent to the rangers without delay.

RANGER STATIONS

Here and there throughout the mountains you will see ranger stations, which are the homes of the forest rangers and are located at central points within their respective districts. You can always recognize a ranger station by the American flag which flies from the flagpole in front of the house. During the summer months these rangers are assisted by guards, patrolmen, and firemen. Before the

season opens they see that there is an ample supply of fire-fighting equipment distributed to points where it will most likely be needed in case of fire. This equipment consists of axes, shovels, rakes, mattocks, hoes, canteens, cooking utensils, and emergency food rations, and sometimes pumps. It must be kept in good condition and ready for use at all times.

The rangers also have arrangements with merchants, garage men, ranchers, and employers of labor, so that when big fires are reported they can, on very short notice, get men for fire fighters, transport them to the fire line, and forward food supplies and equipment.

HOW FIRES ARE PUT OUT

When the report of a fire is received, the warden or forest ranger or one of his assistants may go to it alone, if it is a very small fire, or three or four men with rations may be sent. If the report indicates

F-200040

FIG. 26.—The eye of the forest. A careful watch is kept over forested areas in Washington by men stationed in lookout towers on high peaks

that the fire is likely to become a big one, a large number of men with fire-fighting tools are summoned and sent to the scene of the fire as rapidly as possible. Food supplies sufficient for several days, and other equipment follow by slower transportation, because the rangers always keep working at the fire until it is completely out and do not want to waste time in going back and forth for food, bedding, and tools.

Small fires in grass and forest litter can often be beaten out with branches, wet sacks, shovels, etc. Brush fires, if burning fiercely, are not so easily handled, and it is usually necessary to clear, some distance in advance of the fire, a wide trail or fire line, which the flames can not cross. In clearing this fire line advantage is taken of open spaces in the brush, which will permit the work to be done more rapidly, and of tops of ridges, where the fire does not usually burn so fiercely. Often back-firing is necessary to control big fires. This consists of building a fire along a road or trail or other favorable place

where it can properly be controlled and allowing it to burn back toward the main fire. A back fire, however, if not carefully handled is likely to get beyond control and do serious damage. It should, therefore, be used only by experienced fire fighters. A big fire running through the tops or crowns of trees is almost impossible to control until there is a change in the wind or other favorable conditions arise.

In all fire fighting advantage must be taken of every natural condition. A fire may burn rapidly up steep canyon sides, but may be stopped easily at the top of a ridge. Fires usually die down during the night, and the best time for fighting them is immediately after daybreak when the humidity is high.

Humidity is the amount of moisture in the air and is a very important factor in fire fighting. When the air is hot and dry, we

F-200037

FIG. 27.—Eternal vigilance. The lookout on the mountain peak. He locates the fire in the forest or on the ground with his fire finder, then places the location on the map, and reports to the ranger or fire warden

say that humidity is low, and at such times fires are very easily started and burn fiercely. But at night and during periods of fog or storm, when the air is damp and the humidity high, fires die down and are more easily fought and extinguished.

WHAT YOU CAN DO TO PREVENT FIRES

It is the duty of everyone who goes into the forests, whether on business or pleasure, to help in putting out fires, and what is more important to help prevent them from starting.

Furthermore, you should make it a point to influence others by your words and actions, to be very careful in the use of fire at all times. You should get acquainted with the forest rangers and wardens and know how to reach them quickly in emergencies. If a small fire is discovered that you can extinguish alone, you should, of course, do so, making certain that no embers remain that might

cause it to start again. If the fire is too large to handle alone, you should report it at once to the nearest Federal or State forest officer. Remember minutes count in reporting forest fires.

F-191024

FIG. 28.—Fighting a forest fire

QUESTIONS

1. Name two ways in which forest fires may be detected.
2. What are the principal uses of airplanes in forest protection?
3. How can you recognize a ranger station?
4. What arrangements do rangers make in advance, so as to be ready when big fires break out?
5. What would you do if you should discover a small fire? A large one?
6. What can you do to help prevent fires?

SIX RULES FOR PREVENTING FIRE IN THE FORESTS

1. *Matches.*—Be sure your match is out. Break it in two before you throw it away.

2. *Tobacco.*—Be sure that pipe ashes and cigar or cigarette stubs are dead before throwing them away. Never throw them into brush, leaves, or needles.

3. *Making camp.*—Before building a fire, scrape away all inflammable material from a spot 5 feet in diameter. Dig a hole in the center, and in it build your camp fire. Keep your fire small. Never build it against trees or logs, or near brush.

4. *Breaking camp.*—Never break camp until your fire is out—dead out.

5. *Brush burning.*—Never burn slash or brush in windy weather or while there is the slightest danger that the fire will get away.

6. *How to put out a camp fire.*—Stir the coals while soaking them with water. Turn small sticks and drench both sides. Wet the ground around the fire. If you can not get water, stir in earth and tread it down until packed tight over and around the fire. Be sure the last spark is dead.

FORESTRY PUBLICATIONS WHICH WILL BE HELPFUL TO THE TEACHER

Forests and Forestry in the United States, by Herbert A. Smith, Forest Service.

Idle Land and Costly Timber, by W. B. Greeley, Forester, Forest Service, U. S. Dept. of Agr. Farmers' Bulletin No. 1417. 22 p., illus. 1924.

Government Forest Work. U. S. Dept. of Agr., Circular 211. 47 p., illus. 1922.

How the Public Forests Are Handled, by Herbert A. Smith, Forest Service, Separate No. 847 from Yearbook of U. S. Department of Agriculture. 30 p., illus. 1920.

Timber Growing and Logging Practice in the Douglas Fir Region, by T. T. Munger, Forest Service, U. S. Dept. of Agr. Bulletin No. B 1493. 42 p., illus. 1927.

Washington Road and Information Map Folder.

In the Open. Descriptive booklet of Washington's recreation features.

A Mountain Vacation Land. Description booklet of the Mount Baker National Forest.

Information folders and maps of the following national forests in Washington: Chelan, Colville, Olympic, Snoqualmie, Columbia, Mount Baker, Rainier, Umatilla, and Wenatchee.

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